

**Region 4**  
**U.S. Environmental Protection Agency**  
**Science and Ecosystem Support Division**  
**Athens, Georgia**

**OPERATING PROCEDURE**

**Title: Field Specific Conductance Measurement**

**Effective Date:** August 30, 2012

**Number:** SESDPROC-101-R5

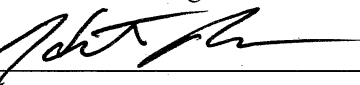
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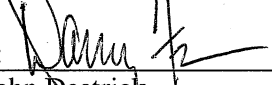
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## Revision History

This table shows changes to this controlled document over time. The most recent version is presented in the top row of the table. Previous versions of the document are maintained by the SEDS Document Control Coordinator.

| History   | Effective Date   |
|---|------------------|
| <p>SESDPROC-101-R5, <i>Field Specific Conductance Measurement</i>, replaces SEDSPROC-101-R4</p> <p><b>General:</b> Corrected any typographical, grammatical, and/or editorial errors.</p> <p><b>Title Page:</b> Changed the Ecological Assessment Branch Chief from Bill Cosgrove to John Deatrick.</p> <p><b>Section 3.4:</b> Added paragraphs 1 and 2 concerning performing operational checks during the day.</p>  | August 30, 2012  |
| <p>SESDPROC-101-R4, <i>Field Specific Conductance Measurement</i>, replaces SEDSPROC-101-R3</p> <p><b>Cover Page:</b> Hunter Johnson was added as co-author. The EIB Branch Chief was changed from Archie Lee to Danny France. The FQM was changed from Liza Montalvo to Bobby Lewis.</p> <p><b>Section 3.2:</b> Replaced the first paragraph with the following language for clarification purposes: “Many brands of instruments are commercially available for the measurement of specific conductance incorporating a wide variety of technologies. The manufacturer’s instruction manual should be consulted for specific procedures regarding their calibration, maintenance and use. Calibration of any measurement instrument must be conducted and/or verified prior to each use or on a daily basis, whichever is most appropriate.”</p> <p>In the second paragraph, revised the language of the first sentence to clarify documentation procedures associated with the effect of temperature on conductivity. Replaced the second sentence with “The following are basic guidelines for calibration/verification and are provided as an example:”</p> <p>The note found in Item # 3 was revised to clarify the relationship between calibration standards and the anticipated specific conductance.</p> <p>In Item # 6, the third sentence was replaced with the following: “Certain meters may require that the instrument be left on until all sample measurements are performed and the results are recorded.” In the forth sentence, replaced “it is recommended” with “certain instrument manufacturers recommend.”</p> <p><b>Section 3.3:</b> In the first sentence, replaced “must” with “should.”</p> | January 13, 2012 |

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| <p>SESDPROC-101-R3, <i>Field Specific Conductance Measurement</i>, replaces SESDPROC-101-R2</p> <p><b>General:</b> Corrected any typographical, grammatical and/or editorial errors.</p> <p><b>Cover Page:</b> The Author was changed from Ron Phelps to Timothy Simpson. The Enforcement and Investigations Branch Chief was changed from Antonio Quinones to Archie Lee. The FQM was changed from Laura Ackerman to Liza Montalvo.</p> <p><b>Section 1.2:</b> Added the following statement: Mention of trade names or commercial products does not constitute endorsement or recommendation for use.</p> <p><b>Section 1.3:</b> Omitted the reference to the H: drive of the LAN.</p> <p><b>Section 3.1:</b> Added “microsiemens per centimeter (<math>\mu\text{S}/\text{cm}</math>)” in addition to micromhos per centimeter (<math>\mu\text{mhos}/\text{cm}</math>) to the first sentence.</p> <p><b>Section 3.2:</b> Item #3 - Added the following statement: “Fresh standards should be used for each calibration. Item #4 - Added language related to the auto-recognition of standards during meter calibration (first 3 sentences). Added items #5 and #6.</p> | <p>August 12, 2011</p> |
| <p>SESDPROC-101-R2, <i>Field Specific Conductance Measurement</i>, replaces SESDPROC-101-R1</p> <p><b>Cover Page:</b> Author was changed from Marty Allen to Ron Phelps.</p> <p><b>Revision History</b><br/>Changed Field Quality Manager to Document Control Coordinator.</p> <p><b>Section 1.3</b><br/>Changed Field Quality Manager to Document Control Coordinator.</p> <p><b>Section 2</b><br/>Added requirements for unattended deployment of in-situ monitoring equipment.</p> <p><b>Section 3.2</b><br/>Added sentence to paragraph 2 to identify minimum requirements for calibration/verification.</p> <p><b>Section 3.3</b><br/>Moved operational check to Section 3.4.</p>   | <p>June 13, 2008</p>   |

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| <p>SESDPROC-101-R1, <i>Field Specific Conductance Measurement</i>, replaces SESDPROC-101-R0</p> <p><b>General</b><br/>Deleted all references to SOSA.</p> <p>Updated referenced procedures due to changes in title names and/or to reflect most recent version.</p> <p><b>Title Page</b><br/>Changed title for Antonio Quinones from Environmental Investigations Branch to Enforcement and Investigations Branch. Changed Bill Cosgrove's title from Acting Chief to Chief.</p> <p><b>Section 1.3</b><br/>Updated information to reflect that procedure is located on the H: drive of the LAN.</p> <p><b>Section 1.4</b><br/>Alphabetized and revised the referencing style for consistency.</p> <p><b>Section 2</b><br/>Added last paragraph regarding stopping measurements due to environmental conditions.</p> | <p>November 1, 2007</p>  |
| <p>SESDPROC-101-R0, <i>Field Specific Conductance Measurement</i>, Original Issue</p>   | <p>February 05, 2007</p> |

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# **1 General Information**

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## **1.1 Purpose**

This document describes procedures, methods and considerations to be used and observed when conducting field specific conductance measurements in aqueous phase environmental media, including groundwater, surface water and certain wastewaters.

## **1.2 Scope/Application**

The procedures contained in this document are to be used by field investigators when measuring the specific conductance of aqueous phase environmental media in the field. On the occasion that SESD field investigators determine that any of the procedures described in this section cannot be used to obtain specific conductance measurements of the media being sampled, and that another method must be used to obtain said measurements, the variant instrument and/or measurement procedure will be documented in the field logbook, along with a description of the circumstances requiring its use. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

## **1.3 Documentation/Verification**

This procedure was prepared by persons deemed technically competent by SESD management, based on their knowledge, skills and abilities and has been tested in practice and reviewed in print by a subject matter expert. The official copy of this procedure resides on the SESD local area network (LAN). The Document Control Coordinator is responsible for ensuring the most recent version of the procedure is placed on the LAN and for maintaining records of review conducted prior to its issuance.

## **1.4 References**

SESD Operating Procedure for Equipment Inventory and Management, SESDPROC-108, Most Recent Version

SESD Operating Procedure for Logbooks, SESDPROC-010, Most Recent Version

United States Environmental Protection Agency (US EPA). 2001. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual. Region 4 Science and Ecosystem Support Division (SESD), Athens, GA

US EPA. Safety, Health and Environmental Management Program Procedures and Policy Manual. Region 4 SESD, Athens, GA, Most Recent Version

## **1.5 General Precautions**

### ***1.5.1 Safety***

Proper safety precautions must be observed when conducting field specific conductance measurements. Refer to the SESD Safety, Health and Environmental Management Program Procedures and Policy Manual and any pertinent site-specific Health and Safety Plans (HASPs) for guidelines on safety precautions. These guidelines, however, should only be used to complement the judgment of an experienced professional. Address chemicals that pose specific toxicity or safety concerns and follow any other relevant requirements, as appropriate.

### ***1.5.2 Procedural Precautions***

All field specific conductance measurements pertinent to the sampling event, including a unique, traceable identifier for the instrument, such as a property number or serial number, should be recorded in the field logbook for the event. All records should be entered according to the procedures outlined in the SESD Operating Procedure Logbooks (SESDPROC-010, most recent version).

Care should be taken to not contaminate standards and samples and verify the expiration date of all standards prior to use. All meters should be calibrated, operated and maintained according to the manufacturer's specifications.

## 2 Quality Control

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All specific conductance meters will be maintained and operated in accordance with the manufacturer's instructions and the SESD Operating Procedure for Equipment Inventory and Management (SESDPROC-108, most recent version). Before a meter is taken to the field, it will be properly calibrated or verified, according to Section 3.2 of this procedure, to ensure it is operating properly. These calibration and verification checks will be documented and maintained in a logbook.

The ambient temperature in the immediate vicinity of the meter should be measured and recorded in the field logbook to ensure the instrument is operated within the manufacturer's specified range of operating temperatures. For instruments that are deployed for in-situ measurements, the temperature of the medium being monitored should be measured and recorded in the logbook prior to deployment. *In-situ monitoring equipment may be utilized in unattended deployments where autonomous logging may preclude temperature measurement prior to deployment. Because in-situ instrumentation generally has a wide range of operating temperature, the field investigator may utilize professional judgment in determining if the operating environment is suitable for unattended deployment.*

If at any time during a field investigation it appears that the environmental conditions could jeopardize the quality of the measurement results, the measurements will be stopped. This will be documented in the field logbook.



## **3 Field Specific Conductance Measurement Procedures**

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### **3.1 General**

Specific conductance is a measure of the ability of an aqueous solution to conduct an electric current and is customarily reported in microsiemens per centimeter ( $\mu\text{S}/\text{cm}$ ) or micromhos per centimeter ( $\mu\text{mhos}/\text{cm}$ ) at 25°C. It is important to note that if the specific conductance measurements are for NPDES reporting purposes, the meter and conductivity cell should be verified by comparing against a laboratory meter with a platinum-electrode type conductivity cell.

### **3.2 Instrument Calibration and Verification**

Many brands of instruments are commercially available for the measurement of specific conductance incorporating a wide variety of technologies. The manufacturer's instruction manual should be consulted for specific procedures regarding their calibration, maintenance and use. Calibration of any measurement instrument must be conducted and/or verified prior to each use or on a daily basis, whichever is most appropriate.

Conductivity is affected by temperature; therefore, for instruments that do not automatically compensate for temperature, the user should document temperature first so that appropriate adjustments can be made in accordance with the manufacturer's instructions and/or method. The following are basic guidelines for calibration/verification and are provided as an example:

1. Verify the meter's internal temperature sensor (thermistor) against a National Institute of Standards and Technology (NIST) traceable thermometer and note any differences between the thermistor and the NIST-traceable thermometer in the logbook. If the temperatures do not agree within  $\pm 4^\circ\text{C}$ , the unit must be repaired or replaced. Alternatively, if the meter can be used in a manual temperature compensation mode, the NIST-traceable thermometer may be used for temperature readings and the necessary corrections applied. Check and record the temperatures of the standards and the samples.
2. Rinse the probe with de-ionized water and blot dry before conducting the following calibration and verification checks.
3. Immerse the probe in the first standard solution and calibrate or verify the meter against that solution. Fresh standards should be used for each calibration. After the initial standard, calibrate and/or verify the meter using additional standards, as appropriate. Rinse the probe with de-ionized water and blot dry or otherwise remove excess rinse water between the different standards. Record the standard values/temperatures used to calibrate or verify the meter.

Note: Some instruments require that calibration standards reflect the

anticipated specific conductance of the media being measured.

4. Some meters will auto-recognize standards during calibration. For example, the Orion Star Series meter will auto-recognize standards 1413  $\mu\text{S}/\text{cm}$ , 100  $\mu\text{S}/\text{cm}$  and 12.9  $\text{mS}/\text{cm}$ . If the meter is calibrated in a manner where it does not auto-recognize the standard, and the meter is not accurate to within  $\pm 10\%$  of the standard solution(s) known values, the meter or probe should be repaired or replaced. If this condition can be corrected by adjusting the cell constant of the probe, refer to the instruction manual and make the adjustment.
5. After calibration is complete, place the probe back into the calibration standard used and record a post-calibration reading. Record a post calibration reading for each standard used. If the meter is not accurate to within  $\pm 10\%$  of the standard solution(s) known values, it should be recalibrated. If it is still outside of the acceptable accuracy range after the second calibration, the probe and/or meter should be replaced.
6. Once the meter has been properly calibrated and verified (steps 1-5 above), it is ready for use. Rinse the probe with de-ionized water and store it in the manufacturer's recommended storage solution. Certain meters may require that the instrument be left on until all sample measurements are performed and the results are recorded. When collecting measurements from grab samples, certain instrument manufacturers recommend that an intermediate check(s) be performed by periodically checking the meter against the known calibration standards if used for extended periods ( $> 4$  hrs).

### **3.3 Sample Measurement Procedures**

The following procedures should be followed when conducting field specific conductance measurements of grab samples:

1. Collect the sample, check and record its temperature.
2. Correct the instrument's temperature adjustment to the temperature of the sample (if required).
3. Immerse the probe in the sample keeping it away from the sides and bottom of the container. It is important that the center portion of the probe be wetted by the sample.
4. Allow meter to stabilize. Record the results in a logbook.
5. Rinse probe with de-ionized water.

The following procedures should be followed when conducting in-situ field specific conductivity measurements:

1. Place the probe into the media to be measured and allow the specific conductivity and temperature readings to stabilize. Once the readings have stabilized, record the measurements in the logbook.
2. When deploying meters for extended periods of time, ensure the measurement location is representative of average media conditions.

### **3.4 Operational Checks**

Even though it is not necessary to re-calibrate conductivity meters at regular intervals during the day, depending on the instrument, it may be appropriate to occasionally perform operational checks to determine if site conditions, such as an extreme temperature change, have impacted the meter's performance. If an operational check is warranted, the following procedures should be followed to ensure that the performance of the meter has not changed.

Check the conductivity meter with fresh conductivity standard. Rinse the conductivity probe with deionized water, blot dry or otherwise remove excess rinse water and immerse it into the appropriate conductivity standard. If the measured conductivity value is not within  $\pm 10\%$  of the standard, the probe should be re-calibrated. If the probe is still not within  $\pm 10\%$  of the standard, the probe should be repaired or replaced. These measurements must be recorded in the field logbook.

A post-operation instrument verification check should be performed using the appropriate standard(s) at the end of the day or after all measurements have been taken for a particular period of operation. These measurements must be recorded in the field logbook.